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Beyond stability: Predicting inter-individual differences in intra-individual change

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Abstract

Demonstration of a high longitudinal stability of inter-individual differences in behaviour has been one traditional goal of personality psychology. In recent years, impressively high longitudinal correlations have been reported for self- and other-ratings of behaviour in adulthood, indicating a high overall stability of personality differences in that period of development. However, even 5-year correlations around 0.70 do not exclude major deviations of some *of the subjects from this overall stability (i.e.* differential *stability in the sample). Furthermore, the younger a sample is, the lower will be the longitudinal stability observed, and the less sufficient is the explanation of inter-individual differences by static traits. This article goes beyond the notion of stability at the sample level by asking from a developmental perspective (a) whether systematic inter-individual differences in intra-individual change exist, (b) how they can be assessed, and (c) whether these inter-individual differences can be explained by characteristics of the person or of the environment.*

INTRODUCTION

The very notion of a personality trait implies that the observed inter-individual differences that are interpreted at the construct level as a trait are stable over time to a considerable degree. If we repeatedly assessed inter-individual differences with methods of a high reliability and with only weeks or months between assessments, and if we found that the observed inter-individual differences fluctuated strongly from one assessment to the next, we could hardly argue that our measures reflect a personality trait. Instead, we might have measured the subjects' mood, motivation, or other rapidly fluctuating states. Thus, proving a high short-term retest stability of inter-individual differences is a necessary requirement for any study of personality.

Besides this important function for the psychology of personality, analyses of stability serve an additional, separate purpose. If the retest interval is longer (years instead of weeks or months), these long-term stability data provide important infor-

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mation about personality *development*. How much do people change in a particular trait over longer time periods? If the long-term stability is lower than one can expect on the basis of the short-term retest reliability data, and if the assessments have a high construct validity at both measurement points for the same trait, some subjects of the given sample must have changed in this trait.

Sometimes the stability of a trait is confused with the temporal constancy of the individual scores. But, in principle, stability is independent of intra-individual change; if all subjects of a sample change a lot, but to the same amount and in the same direction, their rank order is not changed and the stability is 1.0 (correlations are independent of changes in means). Stability does not reflect an absence of intra-individual change, but an absence of *inter-individual differences in intra-individual change*.

TWO PRINCIPLES OF THE LONG-TERM STABILITY OF TRAITS

In recent years, longitudinal studies of adult personality have reported impressively high stability coefficients for self- and other-ratings of personality that were assessed after long retest intervals (up to 45 years; see, for example, Block, 1977; Conley, 1984, 1985; Costa and McCrae, 1988; West and Graziano, 1989). For example, Conley (1984) reported stabilities of 0.65 for extraversion and 0.62 for neuroticism over a 19-year period; over a 45-year period during which the assessment instrument was changed, correlations of 0.26 for extraversion and 0.33 for neuroticism were found.

The results of these longitudinal studies of adults' personality traits suggest a first principle: the longer the retest interval is between assessments, the less stable are the observed inter-individual differences. Conley (1984) has demonstrated that this rule of thumb can be expressed more precisely. In a meta-analysis of 60 longitudinal studies of personality and self-opinion, he showed that the decreasing stability coefficients with increasing retest intervals could be well approximated by power functions of the type $C = Rs^n$, where C is the observed stability coefficient, R is the internal consistency of the measuring instrument, s is the annual stability, and n is the number of years between the two assessments on which C is based.

For example, the 19-year and 45-year stabilities of 0.62 and 0.33 for neuroticism can be approximated by the function $C = 0.90 \times 0.98^n$, which yields estimates of 0.61, and 0.36, respectively. Thus, the true annual stability of neuroticism would be estimated as 0.98 by this method. This formula rests upon the assumption that *systematic* instability (the instability that remains if the unreliability of measurement has been controlled) is due to the continuous accumulation of small changes of personality that occur with a constant rate throughout the whole observation period.

This is quite a bold hypothesis at the individual level, but at the sample level it leads to fairly good approximations of stability over retest intervals of varying lengths because stability applies to aggregates of individuals. Of course, there exist strong inter-individual differences in personality changes for certain periods of time, but they appear to cancel each other out to a great extent. What remains observable at the sample level is a rather robust index of stability which—if standardized for a certain retest interval such as 1 year—characterizes personality traits. For example, on the basis of 60 longitudinal studies of adults' personality, Conley (1984) estimated the annual true stability of intelligence as measured by IQ tests as 0.995, of self-rated extraversion and neuroticism as 0.98, and of self-opinion (mainly measures of life satisfaction) as 0.93.

A second principle concerning stability stems from studies of the development of inter-individual differences during infancy, childhood, and adolescence: the younger the subjects are, the lower is the stability of inter-individual differences over a retest interval of constant length (see, for example, Brim and Kagan, 1980; Digman, 1989; Giuganino and Hindley, 1982). Stability is low during infancy and increases progressively until it reaches its maximum in adulthood. For example, predictions of preschool children's IQ from traditional measures of infants' IQ have rarely overcome a 0.30 barrier (Kopp and McCall, 1980), whereas Wilson (1983) found a continuous increase of the uncorrected 1-year stabilities of IQ from 0.74 (age 2–3) to 0.90 (age 8–9).

Many different factors contribute to this *stabilization* of inter-individual differences during development. A first factor that always should be controlled is the increasing reliability of measurement with increasing age. Particularly in infancy it is difficult to assess behaviour with high short-term reliability, although this problem can be solved by aggregation over many observations (see Epstein, 1979, 1986, for the merits of aggregation). But even if age differences in the reliability of measurement are controlled by correction for attenuation, in most cases a stabilization effect will remain; that is, the 1-year stabilities will still show an increase with increasing age.

A second factor that may sometimes contribute to the stabilization of inter-individual differences is often neglected in discussions of stability: an increasing *construct validity* of the behaviours chosen as empirical indicators of the construct under study (see Cronbach and Meehl, 1955, for the concept of construct validity). In recent years, different research groups have found surprisingly high correlations between highly aggregated measures of infants' visual attention and preschool IQ [e.g. 0.60 between visual attention at the age of 6 months and the Stanford–Binet IQ at the age of 3 years (Bornstein and Sigman, 1986; Rose, Feldman and Wallace, 1988)]. These correlations are much higher than those obtained for traditional tests of infants' IQ which had about the same short-term retest reliability as the visual attention measures. This discrepancy suggests that the traditional measures of infants' intelligence had a poor construct validity and that the lower stability of intelligence at young ages claimed by older studies was partly due to differences in the construct validity of the applied IQ test.

A third, also often neglected, factor contributing to the increasing stability of inter-individual differences is an increasing *continuity* of the *construct* underlying the observed behaviours. Many personality traits refer to differences in the functioning of neural systems or to differences in acquired knowledge. Before these systems have begun to function or before this knowledge has been acquired during development, the trait simply does not exist, and it makes no sense to assess it. And if the nature of the trait changes due to changes in gene activity, experience, or their interactions, this discontinuity of the construct will severely limit stability.

I have recently suggested a new method of empirically assessing the continuity of a single construct independent of its stability (Asendorpf, 1992). Basically, the temporal constancy of the validity structure of many behavioural indicators of a trait is assessed. In a first application of this method to the trait of shyness toward strangers, I have found that shyness shows a high continuity between preschool age and adulthood. Future studies will find out how much the increasing stabilization of observed inter-individual differences is due to discontinuities or poor operationalizations of the underlying traits, and how much it is due to an increasing stabilization of inter-individual differences at the *construct level.*

Very often, increasing stabilization is explained by the differential accumulation of experience. Different people learn different things; they gain different knowledge which, in turn, influences their personality in different ways. For example, differences among children's achievement in intelligence tests may stabilize with increasing age because different children grow up in environments that vary in terms of intellectual stimulation.

Less often it is recognized that this line of reasoning rests on the implicit assumption that either the environmental differences themselves are stable, or that they are stable at least during the first years of life and that later instabilities are no longer very important because then the early environmental influences on personality have become crystallized in traits that are highly resistant to change. These assumptions are questionable, though, and have rarely been studied empirically. So far, studies of stability have focused too much on individuals and have neglected to study the differential *development of environments.* Recently, Kindermann and Skinner (1991) have proposed five different models of developmentally relevant environmental changes; these models await empirical testing.

Another factor that may contribute to increasing stability is based on the same accumulation principle, but is less often considered by personality psychologists. Differential genetic activity also accumulates during ontogeny and is crystallized in stable neuroanatomical structures and neurophysiological functions (see Plomin, 1986, for an excellent overview of human developmental behavioural genetics). Nowadays many personality psychologists still appear to share the naive view that if genotypes affect behaviour, they do this 'directly' and 'continuously'. But it is not the genotype that affects behaviour, it is the genes' *activity* that sets in motion a long process leading from the regulation of protein synthesis via enzymatic regulation via neuronal system functioning to behaviour. There is no simple, direct causal link between genes and behaviour.

Furthermore, many genes of the human genome seem to be *never* active during the life course, and consequently do not affect behaviour; and many genes are 'switched on' and 'switched off' during ontogeny and hence may give rise to inter-individual differences if these genes or the timing of their activity differ among individuals (see Plomin, 1986). Despite the fact that the genotype is constant throughout life, gene activity, and hence genetic effects on behaviour, is highly variable across the life span. Therefore, it is not surprising that estimates of genetic influence on inter-individual differences vary widely according to the age of the subjects under study (see Plomin, 1986 for empirical evidence). The influence of gene activity on personality is as complex and as long a process of accumulation as the influence of differential experience on personality.

A last factor contributing to the stabilization of individual differences has been in vogue among personality psychologists for many years now: the active selection and shaping of environments by individuals according to their personality. Different people approach and avoid different situations, and if they can, they also try to change their environment according to their needs and interests (see Scarr and McCartney, 1983; Snyder and Ickes, 1985; Sternberg, 1985). With increasing age, people become more able to control their environment according to their individual preferences, and this increasing personality–environment fit may contribute to the stability of inter-individual differences.

The problem with these interpretations of the observed increasing stabilization of personality is that they are based on principles that may also account for a *decreasing* stability with increasing age. When children grow older, they leave their family and have new experiences; this change might destabilize experience-based inter-individual differences. The effects of genotypic differences do not always accumulate smoothly because new genes may be 'switched on' differentially during development, thereby destabilizing inter-individual differences. Finally, when people are suddenly freed of environmental pressures and become able to control their environment to at least some extent, this may also destabilize inter-individual differences. Thus, it remains essentially an *empirical question* how much each of these possible mechanisms, and their interactions, contributes to the stabilization of personality traits.

THE CONCEPT OF INDIVIDUAL STABILITY

So far, our discussion of the long-term stability of personality traits has been concerned only with the aggregate level: How high is the *average* stability in a sample of individuals? It is important to note that stability is a property of a sample, not of an individual. Only if stability equals $+1$ or -1, do no inter-individual differences in intra-individual change exist; in the realistic case of medium stability, the subjects may vary widely in terms of their deviation from the average intra-individual change. As personality psychologists, we should therefore move beyond mean stability by asking how the inter-individual *variance* of intra-individual change comes about.

For example, when we try to explain an observed instability at the sample level by the principles of an unstable environment, differential gene activity, or limited opportunities of controlling one's environment, we may take the analysis one step further by asking questions about the *differential stability* in the observed sample. Did subjects differ in the degree to which their environment was stable, and does the instability of their environment predict the amount of their intra-individual change? Did subjects differ in their gene activity, and do these differences predict the amount of their intra-individual change? Could subjects control their environment to different degrees, and do these differences predict the amount of their intra-individual change?

Thus, if we want to *explain* instability we must relate some external variables (e.g. the stability of the environment) to the inter-individual differences in intra-individual change *themselves*, not only to a summary score such as a correlation. But how can we measure these inter-individual differences properly? How can the correlation be decomposed into the individual contributions to this overall measure of stability?

Personality psychologists as well as developmental psychologists interested in differential development have devoted surprisingly little attention to this question, probably because so far research has been more concerned with describing stability than with explaining instability. But even a decent description of stability needs more than a correlation. Only in the unrealistic case of a bivariate normal distribution of scores can the distribution of the intra-individual changes be reconstructed from the correlation. Otherwise a particular correlation coefficient can be consistent with a great variety of distributions of intra-individual changes.

Figure 1 illustrates this point. In two samples of the same size, a trait is assessed twice at the same ages (Time 1 and Time 2). The sample means show the same average increase between Time 1 and Time 2 in both samples. Furthermore, the variances of all four assessments are identical, and the stability between Time 1 and Time 2 equals 0.49 in both samples. But an inspection of the intra-individual changes in the two samples reveals a difference between the two samples.

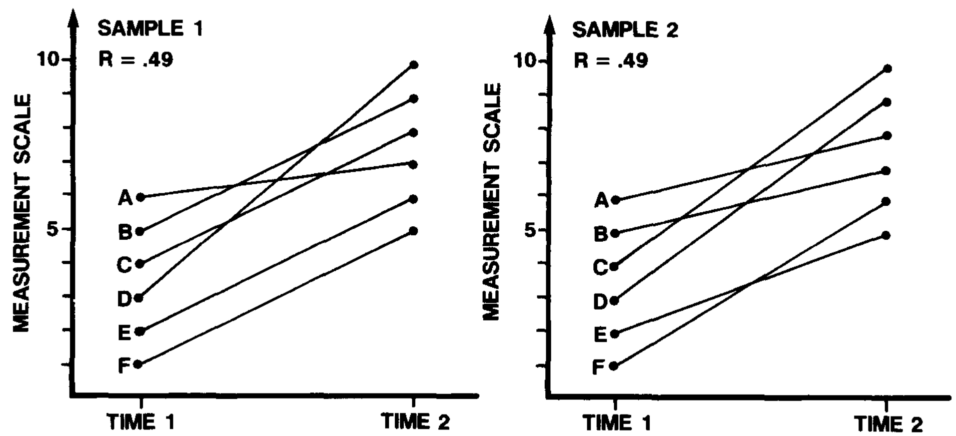

Figure 1. Two data sets demonstrating that the same variances and correlations can reflect different kinds of inter-individual differences in intra-individual change

In Sample 1, four of the six subjects show the same amount of intra-individual change (parallel lines) but the two subjects *A* and *D* deviate strongly from this majority picture. Relative to the majority of the subjects, subject *A* shows a much smaller increase, and subject *D* a much larger increase. If we ignore the differences in the direction of the deviation from the majority picture, both subjects *A* and *D* show the same amount of deviance. Thus, from a stability point of view (which ignores the direction of change), subjects *A* and *D* contribute much more to the instability of the sample than the remaining subjects. In empirical studies of personality change, such an observation would immediately raise the question of why these two subjects should deviate so much from the rest of the sample; for instance, was their environment less stable than the environment of the other subjects?

In Sample 2, the subjects are more homogeneous with respect to their deviation from the average change. While in Sample 1 two subjects deviate strongly from a homogeneous majority, in Sample 2 all subjects deviate somewhat from the average change in the sample. Neither the correlation nor the means or variances of the assessments reflect this difference between the two samples.

What is needed here is a measure of subjects' *individual stability*. The mean of the individual stability scores should be consistent with the correlation as a measure of mean stability, whereas other distributional characteristics of the individual stability scores, particularly their variance, should reflect the differences between the two samples. In the next section, such a measure of subjects' individual stability is described.

THE MEASUREMENT OF INDIVIDUAL STABILITY

Ghiselli (1960) has proposed to regard each individual's absolute deviation from the regression line as a measure of the *predictability* of the individual's change (Ghiselli's description of the procedure is not very clear; see Wiggins, 1973, pp. 61–67, for a better description). If a personality trait is assessed at Time 1 and Time 2, and if x denotes the trait scores at Time 1, y the standardized (z-transformed) trait scores at Time 2, and y' the standardized predictor scores, obtained by the regression equation $\hat{y} = b \cdot x$, the variable $D = |y - y'|$ represents the individual deviations from the regression line. The D score of a subject of the sample is a measure of the 'individual unpredictability' of this subject because the greater the value of D, the more the individual's observed score deviates from the predicted score.

This approach already comes close to the solution of the problem of how individual stability can be measured, but it cannot be regarded as an appropriate solution for three reasons. First, Ghiselli's approach is *asymmetric* in terms of the direction of prediction (an individual's unpredictability at Time 2 in 'forward prediction' is different from the individual's unpredictability at Time 1 in 'backward prediction'). But stability is a *symmetric* concept in terms of the direction of change.

Second, this approach relies on the assumption of a regression-to-the-mean effect. Each person's actual change is compared with the change that would be expected if a regression to the mean existed. It is a widespread belief among psychologists that the regression to the mean is some kind of 'natural law' governing psychological data sets. As Rogosa, Brandt and Zimowski (1982) and others have pointed out, this belief is a myth. A regression to the mean may or may not occur depending on the variable under scrutiny; it can be expected with certainty only if all inter-individual differences in intra-individual change are random (e.g. only due to measurement error). However, if these inter-individual differences reflect in part *meaningful* differential changes in personality traits, that portion of the regression to the mean that is due to measurement error is seriously overestimated by the regression approach, and correcting individual predictability scores for an overestimated regression-to-the-mean effect will lead to biased results.

Third, Ghiselli's approach is not consistent with the correlation as a measure of the mean stability in a sample. Neither the mean of Ghiselli's individual predictability scores nor their median is a simple function of the correlation.

Another approach to the explanation of inter-individual differences in intra-individual change is closely related to Ghiselli's: the *moderator variable approach* (see Saunders, 1956; Paunonen and Jackson, 1985). An external variable M is said to moderate the stability of a trait if in a hierarchical regression approach of predicting the second measurement from the initial measurement and the moderator variable, in addition to the effects of these two predictors a significant effect is found for their product.

This approach shares with Ghiselli's the problem that it is asymmetric and assumes a regression-to-the-mean effect. Furthermore, contrary to Ghiselli's approach, it does not provide indices of individual stability and an analysis of their distribution.

Asendorpf (1989, 1990a) has proposed to regard the score

$$i_{12} = 1 - \frac{(z_1 - z_2)^2}{2}$$

as a measure of *individual stability*, where z_1 and z_2 are the z-transformed scores at Time 1 and Time 2. This approach is symmetric in terms of the direction of prediction and does not assume a regression to the mean. Simple computation shows that the population mean of these scores is *identical to the correlation* r_{12} between the two assessments.[1] Furthermore, the individual stability of a person is identical to the *intra*-individual variance of that person between the two z-transformed assessments subtracted from 1. Thus, this approach is consistent with the notions of both the correlation and the intra-individual variance.

Table 1 contains the individual stability scores between Time 1 and Time 2 for the subjects of the two samples of Figure 1. The sample means of the individual stability scores are identical (as the correlations) but their variances differ; in Sample 1 their variance is much higher than that in Sample 2. This difference reflects the greater heterogeneity of Sample 1 in terms of inter-individual differences in intra-individual change.

Table 1. Individual stability scores for the subjects of Samples 1 and 2 of Figure 1

	Individual stability		Transformed stability	
Subject	Sample 1	Sample 2	Sample 1	Sample 2
A	−0.29	0.43	−0.25	0.46
B	1	0.43	3.80	0.46
C	1	0.43	3.80	0.46
D	−0.29	0.43	−0.25	0.46
E	1	0.86	3.80	1.28
F	1	0.86	3.80	1.28
Mean	0.57	0.57	2.45	0.73
SD	0.66	0.22	2.09	0.42

Note: Transformed individual stabilities are discussed below.

This coefficient of individual stability has the undesirable property that its distribution tends to be strongly skewed to the left. For example, if the two measurements have bivariate normal distributions, it is as skewed as the χ^2 distribution (Asendorpf, 1990a). This skewness poses a problem if we want to correlate the individual stability scores with some external variable. This problem can be solved in two different ways.

Asendorpf (1990a) proposed a strictly monotonic transformation T for normalizing

[1] The mean of the individual stabilities is only identical to the correlation if the correlation is computed with n as the denominator in the formula $r = 1/n \, \Sigma \, z_1 z_2$. Statistical packages use the formula for the best sample estimate of the correlation in the population (with $n-1$ as the denominator). In this case, the mean individual stability deviates slightly from the correlation depending on the proportion $n/(n-1)$.

the skewed distribution of the individual stability scores.[2] He showed with Monte Carlo studies that for approximately bivariate normal distributions this transformation T is very effective in normalizing the distributions of the individual stability scores. Furthermore, applications of the transformation T to dozens of empirical data sets have shown that in most cases the transformed individual scores are approximately normally distributed. Thus, the transformed scores can be correlated with external variables without major problems.

Table 1 contains the transformed individual stability scores for the two samples of Figure 1. The transformed scores reflect the higher variance of the intra-individual changes in Sample 1 just as the raw individual stability scores do. In addition, however, they have a higher mean in Sample 1. This deviation from the correlation or the mean raw individual stability scores is due to the fact that the mean of the transformed scores is less sensitive to 'outliers' such as subjects A and D in Sample 1. In fact, the mean transformed scores appear to be a more robust measure of mean stability than the correlation.

An alternative to this approach at the level of interval scales is to treat the individual stability coefficients simply at the level of ordinal scales. Like the mean of the transformed individual stability scores, the median of the raw individual stability scores is a more robust measure of mean stability than the correlation, and Spearman correlations can be computed between the individual stability scores and external variables. So far, applications of these two approaches to the measurement of individual stability have yielded very similar results.

APPLICATION OF THE CONCEPT OF INDIVIDUAL STABILITY TO THE LONGITUDINAL STUDY OF PERSONALITY

In this section, two applications of the proposed method of analysing individual stability are described (see Asendorpf, 1989, 1990a, for other applications to stability data). In both cases, data of an ongoing study on the development of personality differences in the social and the cognitive domains are used. This study is the Munich Longitudinal Study on the Genesis of Individual Competencies (LOGIC; see Weinert and Schneider, 1986, 1989). In this study, an unselected sample of approximately 200 children of the same birth cohort has been followed from the beginning of preschool through grade 6 over a period of 9 years. Children have been extensively observed and tested three times a year.

One type of question in such a longitudinal study of personality development that can be answered with the proposed method of analysing individual stabilities is whether an observed instability at the sample level reflects meaningful inter-individual differences in intra-individual change in addition to measurement error. This

[2] The transformation proposed by Asendorpf (1990a) is

$$Ti_{12} = \begin{cases} \frac{1}{2} \ln\left[\frac{1.001 + i_{12}}{1.001 - i_{12}}\right] & \text{for } 0 \leqslant i_{12} \leqslant 1 \\ \ln\left[\frac{1}{1 - i_{12}}\right] & \text{for } i_{12} < 0. \end{cases}$$

This transformation is a modification of the well-known z-transformation for correlations introduced by Fisher.

is not a trivial question because measures of change are often particularly sensitive to unreliability (although this problem has been exaggerated in the past; see Rogosa *et al.*, 1982; Schneider, 1989).

One way of dealing with the problem of the unreliability of the individual stability scores is to measure a particular trait with two independent methods and to correlate the individual stability scores of the subjects across methods. This correlation underestimates the true association between the two methods because it is affected by the unreliability of both methods. Despite this problem, if a significantly positive correlation is found, it has been demonstrated that the individual stabilities reflect meaningful inter-individual differences in intra-individual change that are found irrespective of the assessment method. Table 2 presents such data from the LOGIC study.

Table 2. Consistency of the two-year individual stabilities of inhibition within and between two observational settings

Measure of inhibition		P	L	T	O
Parental scale 'Inhibited toward strangers'	P		−0.19	0.21	0.02
Latency toward first utterance to stranger	L	−0.22		0.05	−0.09
Teacher *Q*-sort index 'Inhibited in class'	T	0.18	0.05		0.33*
Observed inhibited behaviour in class	O	0.09	−0.14	0.36*	

Note: Correlations above the diagonal are Pearson correlations between normalized individual two-year stability coefficients. Correlations below the diagonal are Spearman correlations between these coefficients.
*$p < 0.05$.

The social inhibition of children was assessed 2 years apart at the ages of 4 and 6 years in two different observational settings (confrontation with strangers and free play in children's preschool or kindergarten class). In each setting, a judgmental measure (parent or teacher judgment) and a behavioural observation were applied (see Asendorpf, 1990b, for details). Inhibition toward strangers showed a high mean stability (correlation of 0.74 for both measures); because of this high correlation, no meaningful inter-individual differences in intra-individual change were to be expected. The mean stability of inhibition in class was less stable at the aggregate level (correlations of 0.53 and 0.30); this could be due to meaningful differences in children's individual stability.

In fact, Table 2 shows that the individual stabilities of the two measures obtained in the stranger setting were not consistent, but those of the two measures obtained in the class setting were significantly consistent. Thus, teachers' judgment of children's *individual* stability agreed with the behavioural observations of their individual stability. This agreement suggests that there were psychologically meaningful inter-individual differences in children's individual stability in inhibition in their class.

Consequently, the two measures of children's individual stability were aggregated (by averaging their transformed scores). This more reliable measure of individual stability in the class setting was compared between two groups of children: the majority of the sample that remained in the same class with the same teacher throughout the 2-year period of observation, and the minority subsample that experienced a change of class or teacher during these 2 years. The hypothesis was, of course, that the latter group of children would be less stable in their inhibition scores than the control group that stayed in a stable class environment. A t-test confirmed this hypothesis [$t(58) = 2.45, p < 0.02$].

Similarly, children's individual stability in their inhibition toward peers as judged by their parents was related to the stability of their extra-familial social network and—as a control condition—to the stability of their family. It was expected that major changes in children's peer relationships would destabilize their inhibition toward peers. In some cases, inhibition might increase because of the confrontation with new, unfamiliar peers, but other children's inhibition might decrease as well if their inhibition had been primarily due to the social rejection or neglect by particular peers in their former social network. On the other hand, a change in the composition of the children's family was not expected to have an impact on their inhibition toward peers (see Asendorpf, 1990b, for empirical evidence for the existence of different, domain-specific kinds of inhibition among children).

Every year from age 5 to 7, the children's main caregiver was asked to check a list of critical life events if these had happened to the child during the last year. Three of these events indicated major changes in the children's extra-familial social network: the child changed school, the family moved into a new home at least 5 km away from the old one, and close friends of the child moved away from town. Three other events indicated a change in the family environment: a person living together with the child died, such a person left the household (e.g. the father left after a divorce), and the birth of a sibling. Furthermore, every year from age 4 to 7, the children's main caregiver answered four items about the child's inhibition toward peers. These items were randomly distributed among 44 other items of the same response format (a 7-point frequency scale). The internal consistency of this 4-item inhibition scale was high for all four years of assessment (α's of 0.86–0.94).

Table 3 contains the correlations between the number of life events of either type for a particular year of assessment and the individual stability as well as the simple change scores of children's inhibition as judged by their caregiver for this 1-year period.

Table 3. Correlations between individual stability and change in inhibition and the stability of the extra- as well as the intra-familial environment

Age interval (years)	N	Instability of environment: Extra-familial d*	i†	ti‡	Intra-familial d*	i†	ti‡
4–5	83	0.24§	−0.18	−0.23§	0.07	0.07	0.06
5–6	94	0.15	−0.24§	−0.19§	−0.00	−0.08	−0.10
6–7	90	0.13	−0.23§	−0.27§	−0.03	−0.04	−0.00

Note: The instability of either type of environment was assessed by the number of environmental changes (0–3 for each age interval).

*Spearman correlations with simple change scores $d_{12} = x_2 - x_1$, where x_1 and x_2 denote the inhibition score at Time 1 and Time 2, respectively.

†Spearman correlations with individual stability scores i_{12}.

‡Pearson correlations with transformed individual stability scores ti_{12}.

§$p < 0.07$.

Table 3 indicates that a less stable extra-familial environment is associated with less stable inhibition, whereas an analysis of the children's (directed) change does not reveal a consistent relation to environmental stability. Changes in the children's family did not affect the stability of their inhibition toward peers.

These correlational analyses were supported by one-tailed *t*-tests comparing the stability and the change scores of children whose environment changed with children whose environment did not change. For all three intervals of observation, children with a stable extra-familial environment had significantly higher transformed individual stability scores for inhibition than children whose extra-familial environment did change. Furthermore, a comparable analysis of the effects of the stability of the children's family did not reveal any significant effects.

All in all, these analyses demonstrate that we can go beyond correlations if we are interested in the longitudinal stability of personality traits. Stability as well as directed change can be assessed individually, and both of them can be related to external variables such as environmental stability.

BEYOND TRAIT STABILITY

Psychologists interested in personality development can go beyond the analysis of trait stability even further in two directions. First, it is often useful to formulate and to test hypotheses about the *direction* of change. Analyses of stability at the level of the sample or at the level of the individual are insensitive to differences in the direction of change. They only provide information about the *amount* of change. In some cases, this is quite appropriate because the amount of change is more important than its direction (e.g. when environmental instability is correlated with the individual instability of subjects' traits). In other cases, it is not appropriate because clear hypotheses exist about the direction of change (e.g. when children's inhibition in class is related to earlier experiences of being rejected by peers; in this case, it is to be expected that more frequent rejection leads to more inhibition—a directional hypothesis).

If directional hypotheses exist about inter-individual differences in intra-individual change, analysing individual stabilities is not appropriate. Instead, *individual change scores* should be analysed. Simple difference scores are to be preferred to residualized change scores in most cases (see Rogosa *et al.*, 1982, for a discussion). Readers may notice here a fundamental relationship between the analysis of change and the analysis of stability. Simple difference scores correspond to individual stability scores, whereas residualized change scores correspond to the individual predictability scores of Ghiselli (1960). Intra-individual change between more than two points in time can be studied by analyses of (linear or non-linear) intra-individual developmental functions (growth curves; see Bryk and Raudenbush, 1987).

Second, personality psychologists may also be interested to go beyond the 'variable-oriented approach' of the trait concept (Block, 1971; Magnusson, 1988) by analysing the stability of *personality patterns.* In such studies, the longitudinal consistency of the rank order of various traits in terms of their saliency for a particular person is investigated (see Asendorpf and van Aken, 1991; Block, 1971; Block and Block, 1980; Magnusson, 1988; Ozer and Gjerde, 1989). This 'person-centred approach' (Block, 1971; Magnusson, 1988) evaluates the temporal consistency of intra-individual differences in one person. If we follow Allport's (1937) definition of personality as the 'individual organization of behaviour', this type of consistency reflects the consistency of personality more directly than the variable-centred notion of trait stability.

Within this approach, again inter-individual differences in the intra-individual change of personality patterns can be studied. Not surprisingly, different consistencies have been found for different persons with regard to the same sample of traits. For example, Ozer and Gjerde (1989) examined the 3–4-year consistency of personality at various ages within the age range of 3–18 years on the basis of Q-sort descriptions. The consistency scores for the Q-sort patterns varied at least between −0.01 and 0.80 for four age comparisons and both genders. Some subjects were remarkably consistent in their Q-sort pattern, whereas others changed considerably.

Asendorpf and van Aken (1991) found similarly large inter-individual differences in the stability of Q-sort patterns in a German and a Dutch sample of children. Furthermore, they demonstrated that in both samples, the stability of children's Q-sort patterns could be predicted from their *ego resiliency*; that is, their ability to respond flexibly to environmental demands as well as the ability to control one's environment to some extent (see Block and Block, 1980, for a discussion of this construct). A child's ego resiliency was measured by correlating the child's Q-sort profile with the profile of a 'prototypical ego-resilient child'. The higher this correlation, the more similar is the child's Q-sort description to the prototypic personality pattern of a resilient child. Both in the German and in the Dutch sample, children's ego resiliency predicted the stability of their Q-sort profiles during the following 2 years. The correlation between ego resiliency and stability was not a judgment artifact because it was also found when ego resiliency was measured by the Q-sort provided by the child's mother, and the stability of the child's Q-sort was determined for Q-sorts provided by the child's school teacher.

Asendorpf and van Aken (1991) suggested that at least three different mechanisms may contribute to this relationship between ego resiliency and the stability of personality patterns. First, ego-resilient children may buffer their personality against environmental influences by selecting and shaping their environment according to their needs, whereas non-resilient children may be more a victim of their environment; thus, resilient children may stabilize their personality by adapting their environment to their personality.

Second, stability of Q-sort profiles means always consistency of the view that important referent persons (parents, teachers) have. It is not unlikely that a high consistency of this view promotes ego resiliency because the social environment is more predictable.

And third, an important hidden variable may simultaneously increase personality stability and ego resiliency: the stability of the environment. Children who grow up in a generally stable, predictable environment may find it easier to adapt to specific environmental demands. Consequently, they may act more resilient and may be more stable in their personality.

This example demonstrates once more that inter-individual differences in intra-individual change are an interesting, though largely unexplored, area of psychological investigation. The lack of a high stability of inter-individual differences is not, as Mischel (1968) has suggested, a problem for personality psychology if a high short-term stability can be demonstrated. Instead, meaningful inter-individual differences in intra-individual change may exist that provide a valuable source of information about personality development.

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